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Organizing the Production of Agricultural  
Machines by the Constant-Flow Method

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ORGANIZING THE PRODUCTION OF AGRICULTURAL MACHINES BY THE CONSTANT-FLOW METHOD

~~TO BE CONVERTED TO THE PRODUCTION LINE~~

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(INTRODUCTION)

Twenty years ago, the Lyubertsy Agricultural Machine Building Plant Imeni Ukhtomskiy was an enterprise with primitive technology which on the whole required heavy physical labor.

Parts in the foundries were cast on the ground by means of primitive machines and a hand rammer. The workers prepared the sand on the working spaces by hand, shoveling it about and running it through sieves for separating out scrap. They brought facing sand to the working places in wheel barrows. Each molder would pour the <sup>molten</sup> ~~liquid~~ metal into the mold with a hand ladle. Once a shift the workers would form a long line to fill their ladles at the reverberatory or cupola furnace. They knocked out casting<sup>s</sup> from the flask manually, by means of wooden hammers. The casting was also removed from the <sup>an</sup> ~~sand~~ manually. Castings were annealed in compartment furnaces which were loaded with boxes of castings by means of a steam engine. Unloading and loading took place at high temperature, under difficult conditions.

In the machine shops, the basic type of equipment was the drilling machine, which produced only fourth or fifth ~~drilling~~ class accuracy. The equipment was arranged according to the type of machining, (drilling machines in one place, lathes in another), and so parts travelled a very long and winding route, often returning several times from one end of the workshop to the other.

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In the shop, where cutting parts were made, grindstones for grinding segments and sharpening were cooled by running water. Workers wore rubber boots and rubber aprons <sup>at</sup> these machines. The labor conditions in the ~~work~~shop were extremely unhealthy.

All intra- and inter- workshop conveyance was done by hand-carts and wheelbarrows; here and there pneumatic hoists were used. All assembling of parts was done by rivetting. Parts and units <sup>(painted)</sup> were by dipping them into a vat and then drying them in the air.

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During the years of the Stalin five-year plans, especially in the post-war [five-year plan], the Lyubertsy (of the Order of Lenin and of the Order of the Red Banner of Labor) plant imeni Ukhtomskiy, one of the oldest (agricultural machine building enterprises), considerably increased its technical equipment and productive capacity. In many sections of production, operations are no longer performed by hand, but by machines; this ~~operation~~ lightened laborious tasks and increased labor productivity, and improved the quality and reduced the production cost of output.

In the course of the post-war five-year plan, the plant increased its output 6.2 times, and the output per worker 4.3 times. The output was increased not by increasing the number of workers, but by introducing new advanced technology, and especially by mechanizing ~~the~~ labor consuming and heavy tasks in the most important sections of production. The results of this work are apparent also in the reduction of labor consumption ~~in working~~ machines, put out by the plant: Labor consumption in the production of mower <sup>5/</sup> ~~is~~ decreased 18.1% in 1950, of the flax-puller 23%. The net cost of production was also lowered considerably; of the mower 20.6%, of the flax-puller 28.1%.

A large portion of the machine parts manufactured by the plant are made from cast iron; for example, in a mower cast parts make up around 70% of the total of its weight, in a reaper <sup>7</sup> more than 60%. Therefore the mechanization of labor in the foundries occupies a prominent place in the general plant plan of organizational-technical measures.

Much has been accomplished in the gray iron foundry. Previously, the prepared mixture was brought to the casting section in buckets. At the present time, the preparation and conveyance of the sand is completely mechanized. A centralized sand-conditioning machine, which services two conveyers, operates in the foundry. It consists

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of six crusher rolls, a magnetic separator, a drum screen, an aerator, *and* hoists and conveyers for feeding the burned sand and the prepared mixture. A sand-distributing system is set up in the foundry, and hoppers are set up at the working places of the molders. This replaced the manual conveyance of the molding sand to the working places and now sand is poured into the mold boxes from the automatic hoppers by gravity feed, by opening jaw gates, instead of manual filling with shovels.

In the gray iron foundry, the most labor consuming and largest parts - frames and wheels for mowers and reapers - used to be molded by hand on the "plats" (~~assembling~~ yard). The molding of these parts limited the output of machines. Now the frames and wheels are molded in special roller conveyor sections, equipped with mechanized sand-conditioning machines, a system of conveyers and hoppers, shake out grates, and elevators for prepared and burned sand. Molding machines are set up near the roller conveyers. The sand is poured into the flasks from the automatic hopper, and packed down with pneumatic rammers. The prepared flasks are fed onto the roller conveyor by pneumatic lifts. The drag moves to the next working place, after the worker places the cores in it; there, the cope is suspended on a pneumatic hoist which subsequently lowers it onto the drag. After tightening of both halves, the mold moves along the roller conveyor where it is filled with molten metal.

Then the partly-cooled molding is placed on a monorail conveyor *by* a pneumatic lift <sup>(d)</sup> and is conveyed to a shake-out grate. The sand is knocked out of the flask by jolting, and it flows down into the buckets of the burnt sand elevator which feeds it into the drum sieve. From here the sand enters to the hoppers over the crusher rolls. They discharge the sand which ~~has been~~ crushed ~~in the~~ crusher rolls onto

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the conveyer belt, which delivers it to the prepared sand elevator; from there it proceeds to the distributing belt which feeds it into the hoppers by the molding machines. After the castings are knocked out of the flasks, they are carried by a monorail conveyer into the cleaning department, and the flasks are returned to the molding section.

For pouring molten pig iron in the foundries, there are monorails along which trolleys with ladles travel. A system of levers raises and lowers the ladle. The mechanization of the pouring process reduced the number of pourers 2-2.5 times and considerably lightened their labor.

The primitive hand machines <sup>for</sup> manual ramming <sup>of</sup> the molds and drawing off the flasks which were formerly used in the plant foundries, have now been almost completely replaced by pneumatic jolting machines, which lighten the labor of the molder and raise his productivity. The entire process is now done on machines.

The use of one-sided instead of two-sided plates for flaskless molding has proved extremely effective. Both halves of the mold are prepared separately, on two machines, so that one worker makes only one half. This lightens labor and raises its productivity 20-100%.

The mechanization of the molding process produced significant results. Before the war, a brigade of thirteen men cast manually on the factory yard 80-90 wheels (per shift). This work was very heavy, it was necessary to move more than 25 tons of sand (per shift). Since the adoption of mechanized molding, a brigade <sup>2</sup> of nine men casts up to 250-260 wheels per shift, that is three times as many. The production per worker increased 4.5 times.

At the end of 1948, in the gray iron foundry, the first casting conveyer of the suspension type was set up, It is an overhead system along which move the trolleys that have been connected by an endless

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slot chain--the tractive device of the conveyer. Hangers with plates, on which flasks are mounted, are attached to the trolley by ball joints. The plates turn around <sup>an</sup> ~~an~~ axis to eject the flasks onto the knock-out grate.

The suspension casting conveyer possesses a number of advantages over the ordinary type; its construction does not require a great deal of excavation work: the design of its power station is considerably simple, it is no longer necessary to clean the rail and the hand carts, which in ground-type conveyers become clogged with sand and metal <sup>scrap</sup> ~~scrap~~; the bearings and other parts of the drive station wear less; the suspension conveyer requires less space owing to its considerably smaller turning radius. Use of the suspension conveyer has proved its high quality. Such conveyers have found wide~~s~~pread application in our foundries.

In the malleable iron foundry, <sup>the</sup> constant-flow method of making castings was adopted; from molding to the output of finished parts. The foundry has five molding conveyers (three of these were built in the last two years.) All are conveyers of the overhead type. Each of these was intended for a specific group of castings (according to weight, size and other characteristics.) A central sand-conditioning machine was set up in the foundry. From here the molding sand is fed by means of the conveyer belts into the hoppers by the working places of the molders. To carry molten metal from the smelting furnaces the pouring section has been equipped with mono-rail conveyers with suspension trolleys.

From the conveyers, the filled flasks are pushed onto mechanical knock-out grates. Then the hot castings are placed in special boxes on skids which are carried by ~~foundry~~ fork lifts to the section where fins and ribs are knocked off. The pouring gates and the rejected castings are carried back to the mixing yard by the fork lift.

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After trimming, the castings proceed to the annealing department. At the beginning of 1951, the extremely labor consuming operation of breaking-down<sup>ing</sup> and loading of boxes was mechanized. The castings are loaded into the soaking boxes by a bridge crane; the sand for covering the castings enters the boxes from a special hopper. The boxes packed with castings are put on special carts by <sup>the</sup> bridge crane. Push rods feed the carts into the continuous tunnel furnace.

After annealing, the boxes filled with castings proceed to the breaking down process. The hot castings are dumped onto the sloping jolting grate, where they are separated from the sand. The moldings roll off into a cart but the sand flows along the gutter to an elevator which feeds it into a hopper.

Burned sand and scale are removed from the castings in drums or by sand blasting. The dressing of the castings, straightening, the breaking through ~~down~~ and ~~the~~ cleaning out of the holes is done in the department of "soft" cleaning on emery wheels and presses. An electric car is used for transporting the castings into the machine and assembly shops and storerooms.

To complete the mechanization of all operations in the workshop, and also to improve the organization of the work, a new section was created--"hard" cleaning. The conveyance of castings from the knock-out grates to the cleaning and inspecting section was mechanized. In this section, there is a grindstone for dressing the hard moldings which have not been annealed, <sup>and</sup> cleaning drums are replaced with shot blasting units, which improves the quality of the casting. Three such units will be set up in the second quarter <sup>of</sup> 1951.

The plant is mechanizing labor consuming operations by using its own resources. The plant designed and built all necessary machines, mechanisms, <sup>and</sup> transporting devices itself, designing original equipment in a number of cases. The mechanization was carried on without

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interrupting production: for example, the overhead conveyer in the gray iron foundry, which was built by the Chief Mechanic<sup>(12)</sup> Division in one and half months, was set up in place of the old ground-based conveyer within two days without shutting down the shop.

Mechanization has not only lightened labor and increased output but also created much more sanitary and healthy conditions. The mechanization of cleaning in the gray iron workshop can be quoted as an example. In the reconstruction of cleaning department they set up each cleaning drum in a sealed chamber. The dust from the drum is drawn off through hollow axle shafts. The electric power circuit only operates when the doors of the drum are closed, assuring the safety of the operators.

Much has been done to mechanize work in the pickling department of the wire drawing shop. Previously 6-8 bundles of rods, each weighing 500-600 kilograms were loaded into the vats. The loading took 2-3 hours, since the hoisting and transporting devices were primitive, and the quality of the pickling was low; the lower bundles, which were loaded first, were over-pickled because they had been in the vat much longer than the upper.

In the reconstruction of this department the vats for pickling, washing and neutralization were set up in a constant-flow line. Now metal is packed in the warehouse in bundles weighing 1300-1400 kilograms and moves in cars along a narrow gage track to the telfer scaffold. Then ~~and~~ the telfer, supplied with a special cross piece, carries out all operations; it feeds the bundles into the vats, sinks them into the vats, withdraws them from vats, <sup>and</sup> delivers the pickled metal to the grinding machine.

Formerly, in the wire drawing shop metal was transported after drawing (to the cutters) on cars, which were loaded and unloaded manually. In 1950, the equipment was arranged in a constant-flow line,

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and (for transporting the metal) an overhead electro-telpher with a lifting capacity of 1.5 tons was erected. Now the telpher takes up the metal from the drawing bench and feeds it to the cutters, alongside of which there are special racks. Such a mechanization sets free three or four men, busy previously with transporting, and frees them from heavy labor.

One of the most complex production processes at the plant is the preparation of cutting parts, segments and inserts. The surfaces of segments used to be polished on lathes of a primitive lay-out, which required a large expense of physical labor. Using a lever a worker fed the surface of the segment to the grindstone with one hand, and with the other, moved the carriage. Chamfered edges were sharpened on similar machines. At present, the preparation of cutting parts has been radically reorganized, the grinding of surfaces and sharpening of segments is done on semi-automatic machines. Labor productivity increased 9-10 times. The production of reaper frames is now done on lines of combination machine tools. The changes in technology in the machine shops was accompanied by a straightening out of the production line which greatly reduced intra-shop hauling and created an efficient production rhythm.

Every month, the plant processes about 3,000 cubic meters of lumber. For a long time, the woodworking shop was one of the plant bottlenecks. Because of the unsystematic arrangement of equipment the parts run through a winding route, <sup>and</sup> most transporting was done manually. Now the equipment is arranged in a constant-flow line. Lumber is unloaded by an electric-telpher, equipped with an original device for holding the boards, which then proceed by roller conveyer to the sub-assembly department.

The transition to the production line in the carpenter shop greatly lowered the heavy labor consumption of producing articles and shortened

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their route: such a part as the field board, for example formerly travelling a route of 210 meters, now travel<sup>3</sup> only 70 meters.

Use of a conveyer in the assembly of one of the most complex units--the reaper platform proved very effective. Now they are assembled on carts, the work places of the assemblers are fitted with electric-saws, electric drills and other special tools replacing inefficient hand tools. The conveyer system enabled them to assemble not 12 but 30 platforms a shift. The assembly of connecting rods was moved to the conveyer, ~~even~~ doubling labor productivity of the assemblers.

Savvin, built an automatic machine for making reaper rakes. The automatic machine drills holes in the rake bar and presses a wooden prong into each hole. After the prongs of the rake are pressed in, ~~the bar~~ <sup>the bar</sup> emerges from the machine and the next rake bar automatically moves into place.

A paint<sup>ing</sup>-drying conveyer was set up in the section where large parts and units are painted. Formerly, a hoist was used to dip parts and units into vats of paint, fine parts were put into sieves and dipped in paint. Besides the great labor consumption of such methods the quality of painting was low. Parts were dried by natural air currents, and often ~~came~~ <sup>came</sup> to the assembly line undried.

The paint<sup>ing</sup>-drying conveyer consists of drying chambers with ~~paint~~ <sup>paint</sup> vats between them. The parts which are suspended on the conveyer, pass in turn through the vats and drying chambers. The whole process takes around six hours. The conveyer begins in the wheel machining shop on the first floor and passes through to the second floor to the paint shop.

As a result of the introduction of advanced technology and the mechanization of labor consuming tasks, ~~expanding~~ the length of the production cycle of the majority of parts has been significantly shortened. Thus, the production cycle of such complex and labor

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consuming parts as frames mower was reduced during the last two years from 48 to 28 hours. A frame, which has been molded and poured in the morning, enters the machine-assembly shops towards the end of the shift. In the next shift, the frame is machined, assembled, and tested. At the end of the shift, the frame is put on the conveyor for painting and drying, which takes six hours. Then they put the frame on wheels and complete the mower. Toward the end of the following day, the mower is entering the finished articles warehouse.

In 1951, the plant will construct and put into operation a conveyor for transporting finished machines to the warehouse and will mechanize their loading onto freight trains. At present, finished machines are rolled from the assembly shop, which is on the second floor, to the elevators, lowered to the first floor, and then rolled to the warehouses, and from there to the loading platform. On the whole the machine must be transported manually for a distance of more than 300 meters. The conveyor will <sup>carry finished machines</sup> ~~convey them~~ from the assembly ~~work~~ shop, first to the warehouses and then to the loading platforms.

In the post-war years, the plant has done much to mechanize heavy and labor consuming operations. It has to do still more, <sup>-2-</sup> ~~in~~ particularly in the mechanization of intra-workshop and inter-workshop transporting of parts and units.

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